## WINTER– 2017 EXAMINATION

**Model Answer** **Subject Code:** 17544

**Important Instructions to examiners:**

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical spelling errors should not be given more Importance Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

| Q. No. | Sub Q.N. | Answer | Marking Scheme |
|---|---|---|---|
| 1. | (A) | **Attempt any THREE** | 12 |
| | (a) | **List any four analytical Instruments based on Beer & Lambert's law.**<br>**Ans:**<br>1) Colorimeter<br>2) Spectrophotometer.<br>3) Flame photometer<br>4) Filter Photometer<br>5)Single beam Spectrophotometer<br>6) Dual beam Spectrophotometer<br><br>OR Any other relevant instrument | 04 |
| | (b) | **Which sterilizing equipments are used for following application? Justify.**<br>**(i) For removing microdust, clots, and blood stains on the instrument.**<br>**(ii) Various powder in medical use.**<br>**(iii) For sterilizing medical waste.**<br>**Ans:-**<br>**(i) For removing micro dust, clots, and blood stains on the instrument.**<br>The Ultrasonic Cleaner gives 100% cleaning of the surgical instruments and removes miocrodust, bold stains, and clots deposited in the joints and crevices of the instruments. It is the scientific, qualitative and hygienic method cleaning all the surgical instruments and scopes<br>OR<br>Autoclaves provide a physical method for disinfection and sterilization. They work with a combination of steam, pressure and time. Autoclaves operate at high temperature and pressure in order to kill microorganisms and spores. Dry material can be treated in a fast exhaust cycle<br>**(i) Various powders in medical use.**<br>Powders cannot be sterilized by steam because steam will not penetrate the substance; steam condensates on the outside. The correct method for such materials is dry heat means | 04 |

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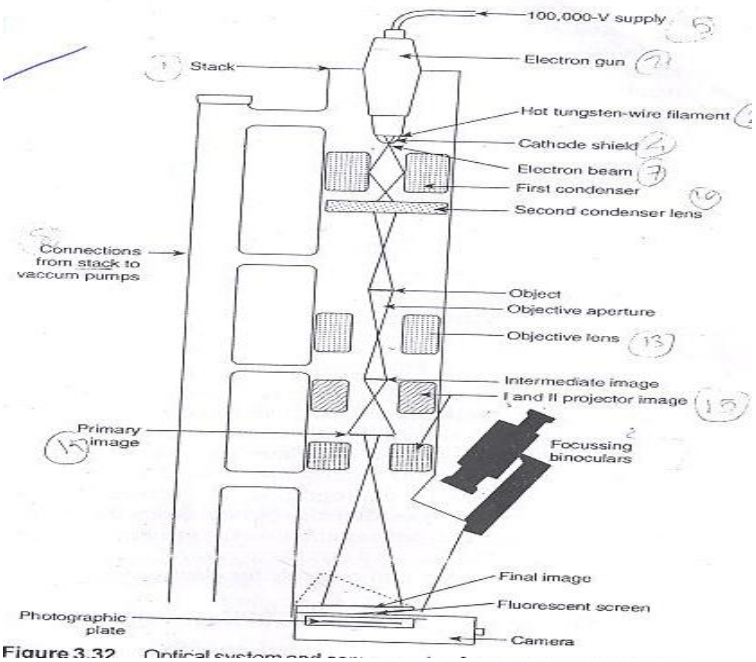
| | | Hot air oven.<br>**(ii) For sterilizing medical waste**<br>Autoclaving is often used to sterilize medical waste prior to disposal in the standard municipal solid waste stream. This application has become more common as an alternative to **incineration** due to environmental and health concerns raised because of the combustion by-products emitted by incinerators.<br><br>**Incinerators:** Incinerators are used for disposal of biomedical waste | |
| | **(c)** | **List any four technical specification of Blood Gas Analyzer.**<br>**Ans:**<br>1. Power supply:-200-240Vac 50Hz.<br>2.Measured parameters:- pH, pCO2, pO2, tHb, Barometric Pressure, Na+, K+, Ca++, Cl-. All these parameters measured simultaneously<br>3. Sample volume:-less than 100ul.<br>4. Analysis time: – less than 60 sec.<br>5. Display: LCD color touch screen display. | **04** |
| | **(d)** | **State types of electronic microscope. Also list its different parts.**<br>**Ans: (Types -2 marks + Parts- 2 marks)**<br>**Types of Electronic microscope**:<br>1) SEM: Scanning Electron Microscope.<br>2) TEM: Transmission Electron microscope<br>**Different parts**:<br>1) Light source<br>2) Mirror lenses.<br>3) Condenser system<br>4) Diaphragm<br>5) Eye piece.<br>6) Photomiographic system | **04** |
| | **(B)** | **Attempt any <u>ONE</u>** | |
| | **(a)** | **Draw a neat labelled diagram of TEM. Also state the function of each part.**<br>**Ans :**<br>  <br><br>Figure 3.32 Optical system and ... | **03** |

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| | | **Electron gum :-**<br>The function of the electron gun is to generate electrons to form the electron beam and direct it down the microscope column through the condenser lens. The electron gun consists of cathode and anode. These electrodes are maintained at 50 kilowatts potential difference with the anode at ground potential.<br>**Condenser lens :-**<br>In microscope the condenser lens controls the concentration or intensity of the electron beam on the specimen. It consists of an ironclad coil with a gap at about the middle of the central opening. Diameter of these lenses is 0.025inch.<br>**Objective lens :-**<br>The objective lens is very much similar in appearance and construction to the condenser lens.<br>The objective lens forms an intermediate image, which can be viewed on the intermediate viewing screen, at a magnification of about eighty diameters. The image is focused by adjusted the objective current.<br>**Diffraction/intermediate lens**: Switching between imaging and diffraction mode.<br>**Projective lenses**: Further magnification of second intermediate image (image or diffraction pattern, respectively).<br>**Image observation**: Images and diffraction pattern can directly be observed on the viewing screen in the projection chamber or via a TV camera mounted below the microscope column. Images can be recorded on negative films, on slow-scan CCD cameras or on imaging plates. | **03** |
| | **(b)** | **What is sterilization? Write stepwise procedure to sterilize medical instruments using autoclave. Also list any two clinical application of autoclave**<br>**Ans:**<br>**Sterilization** is a process in which all the living microorganisms, including bacterial spores are killed.<br>**Procedure:**<br>1) Keep waste in the autoclave.<br>2) Power on the supply.<br>3) Set timing for sterilization.<br>4) Keep the desired pressure for sterilization until the point of condensation at which it draws more steam to the area.<br>**Application:**<br>1. Autoclaves are widely used to cure composites and in the vulcanization of rubber.<br>2. Autoclaves are used for pre-disposal treatment and sterilization of waste materials.<br>3. Autoclaves are used to sterilize the equipment's in the hospitals.<br>4. Autoclaves are also used for sterilization of materials like gowns, dressing, gloves, etc | **02**<br><br>**02**<br><br>**02** |

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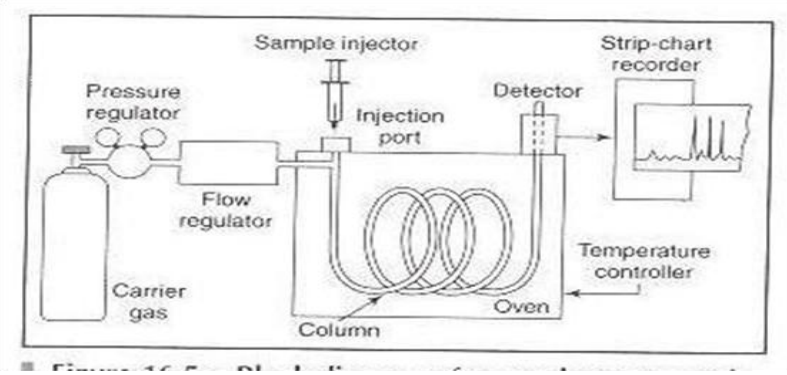
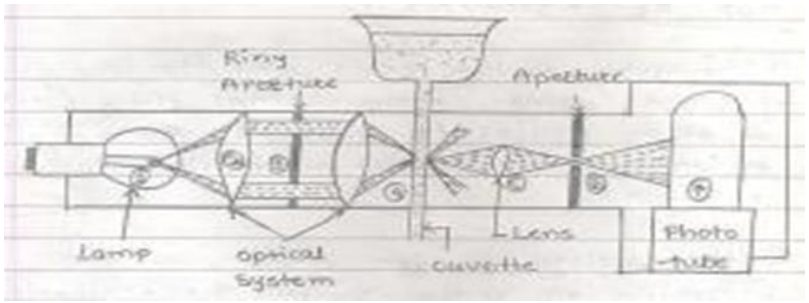
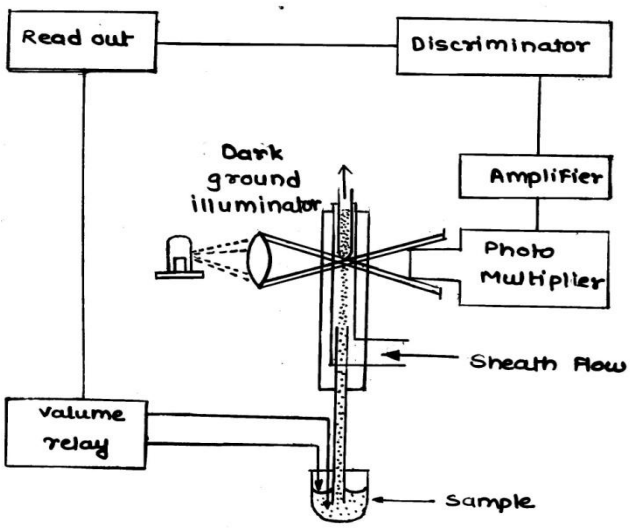
| **2.** | | **Attempt any <u>FOUR</u>** | |
| | **(a)** | **Draw a neat diagram of Gas chromatography & describe it.**<br>**Ans :**<br>  <br><br>The basic parts of a gas chromatograph are shown in figure<br>It consists of the following parts.<br>- Carrier gas supply along with pressure regulator and flow monitor.<br>- Sample injection system.<br>- Chromatographic column<br>- Thermal compartment of thermostat<br>- The detection system<br>- The strip chart recorder<br>The carrier gas, normally $N_2$, Ar or He is usually available in a compressed form in a cylinder fitted with a suitable pressure regulator. The gas is conducted from the cylinder through a flow regulator, to a sample injection port maintained at a certain temperature $T_1$, which is such that it ensures rapid vaporization, but not thermal degradation of the solute. Gas and liquid samples are almost always injected by syringe through a self sealing silicon rubber diaphragm in the injection port. The solute vapor mixes almost instantaneously with the flowing carrier gas and is swept into the chromatographic column, which is the heart of the chromatography.<br>It is there that the different solutes in the vaporized sample are separated from each other, by virtue of their different interaction with the column packing. The column is maintained at another temperature $T_2$. This temperature determines the time for the passage of the solutes and to some extent, the resolution and efficiency obtained with a particular column. At the end of the column the solutes emerging individually enter the detector which produces an electrical signal corresponding to the quantity of solute leaving the column. The detector signal is supplied to a potentiometer recorder and a plot of the time signal amplitude called chromatogram is obtained. | **02**<br><br>**02** |
| | **(b)** | **With neat diagram of optical method for cell counting. Also write its working principle.**<br>**Ans :**<br>  <br><br>**Fig : Dark field blood cell count** | |

**OR**




Optical method of counting cells

**02**

**Working :**

Optical method of counting cells. The method is based on collecting scattered light from blood cells & converting into electrical pulses for counting of red & white cells using optical detection system.

The sample of dilute blood 1:5000 for white cells 1:5000 for red cells is taken in a glass container it is drawn through counting chamber in which the blood stream is reduced in cross section by a concentrated high velocity liquid sheath. A sample optical system provides a dark field illumination & the light scattered in forward direction is collected on the cathode of a photomultiplier tube. Pulses are produced through PMT corresponding to each cell. These cells are amplified in a high input impedance amplifier & fed to an adjustable amplitude discriminator. The discriminator provides pulses of equal amplitude which are used to drive a digital display.

Instruments based on this technique takes about 30 seconds for completing the count the accuracy of 2% is attainable, the instrument required about 1mm of blood sample.

**02**

**(c)** **Draw neat labelled diagram of hot air Oven. Also explain its working.**

**Ans:**

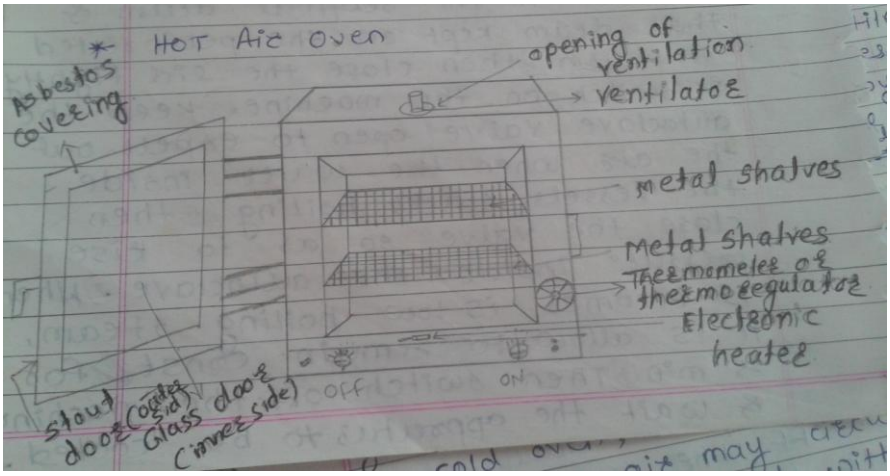



**Fig : Hot Air Oven**

**02**

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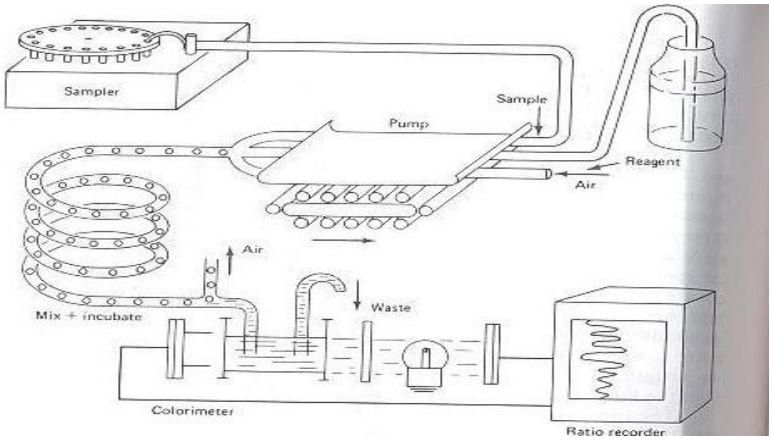
| | | **Construction**:-<br>Double walled, the motor fixed at the back / triple walled, ducted air flow type, the motor fixed at the top. The motorized forced air circulation to maintain uniform temperature inside the chamber. Inner chamber made of stainless steel. Outer chamber made of mild steel. Gasket Asbestos rope or Neoprene rubber (optional) gaskets for the door to avoid air leakage and temperature loss of hot air oven. Trays Two/ Three perforated removable stainless steel trays at the fixed distance. Front panel consists of mains ON/OFF rocker switch | **02** |
| | **(d)** | **Describe construction of Auto analyzer with help of neat diagram.**<br>**Ans :**<br>**Ans:**<br>  <br><br>**Fig : Auto analyzer**<br>**Working :**<br>1) Sampler:- It fits the sample into analyzer in a particular time sequence.<br>2) Proper pump:-It is basically a simple peristaltic pump working simultaneously on a number of with certain ratio of diameter is used to meter the sample & regent.<br>3) Mixing: - mixing is achieved by injecting air bubbles the mixture is incubated while flowing through heated coils. The air bubbles are removed & the solution finally throws the Cuvette of colorimeter or is aspired in to flame photometer.<br>4) Recorder:- An electronic ratio recorder compares the output the reference & sample photocell. The recording shows the individual samples as peak s of a continuous transmittance or absorbance recording. T<br>The samples of a "run" are preceded by a number of standards that cover the useful concentration range of the test. The concentration of the samples is determined from the recording by comparing the peak o f the samples with the peaks of the standards. n this way the effects of errors are eliminated because they affect standards and samples in the same way. The smallest models of the Auto analyzer perform a single test at a rate up to 120 samples per hour. Large later models performs upto 12 different tests on each of 90 samples per hour. | **02**<br>**02** |

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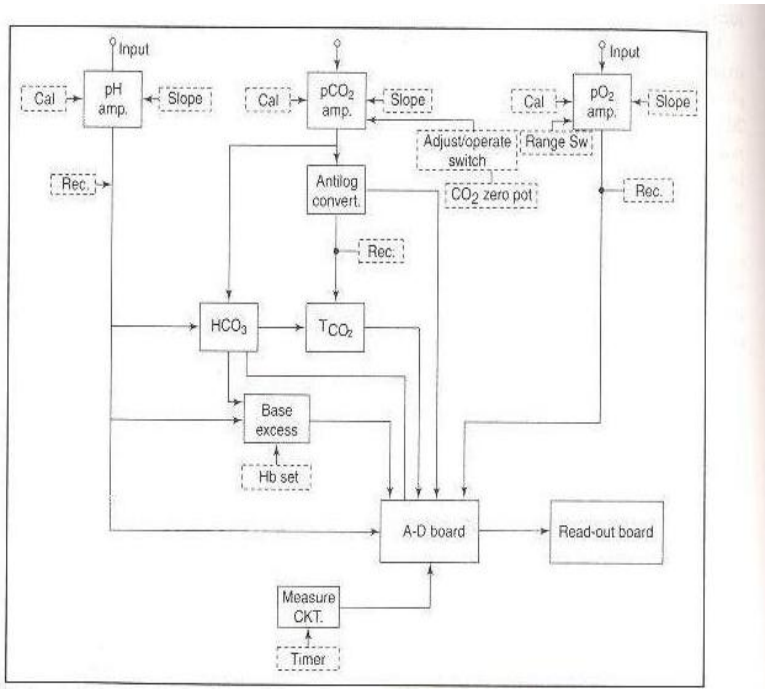
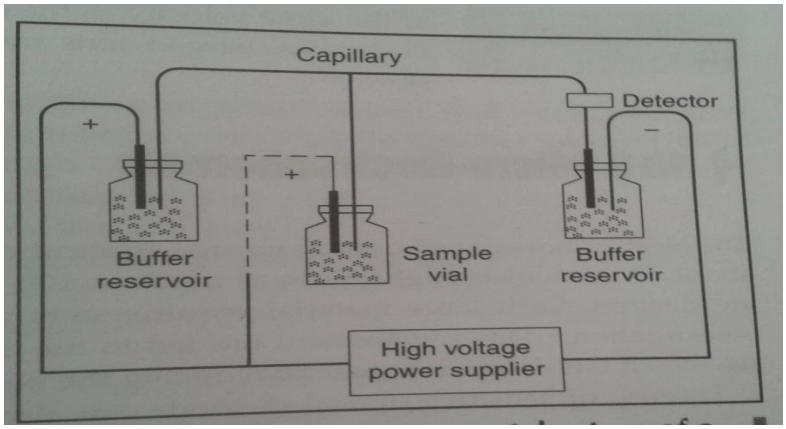
| | **(e)** | **Draw block diagram of Blood gas Analyzer.**<br>**Ans :**<br>  <br><br>**Fig : Blood gas Analyzer.** | **04** |
| | **(f)** | **Describe working of capillary electrophoresis with help of neat diagram.**<br>**Ans :**<br>  <br><br>Fig shows the basic instrumental set of a capillary electrophoresis apparatus. It consists of high voltage power supply (0 to 30KV), a fused silica (s1 o2) capillary, two buffer reservoirs, two electrodes, and an on column detector. Sample injection is done by temporarily replacing one of the buffer reservoirs with a sample vial. A specific amount of sample is introduced by control lining either the injection voltage or the injection pressure. Capillary are typically of 50 micrometer inner diameter and 0.5 to 1 m in length. Capillary electrophoresis uses an electromotive force rather than the pump, to drive the mobile phase through the capillary.Due to electro-osmotic flow, all sample components migrates towards the negative electrode. A small volume of sample (10 nl) is injected at the positive end of the capillary and the separated components are detected near the negative end of the capillary. | **02**<br>**02** |

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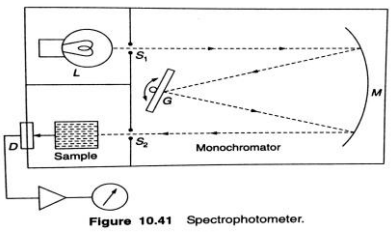
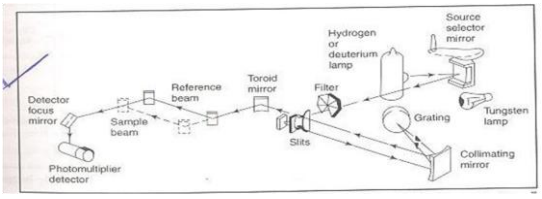
| **3.** | | **Attempt any <u>FOUR :</u>** | **16** |
| | **(a)** | **Compare single beam spectrophotometer with dual beam spectrophotometer. (any four points)**<br>**Ans: (Any Four)** | **04** |

| Single beam spectrophotometer | Duel beam spectrophotometer |
|---|---|
| 1. It consists of one detector. | 1. It consists of two detectors. |
| 2. It is not easy determination of spectral Transmission curves. | 2. It allows easy determination of spectral Transmission curves. |
| 3. Wave length calibration at SPM can be check using holonium oxide filter as wave length standard. | 3. Holonium oxide filter not required for calibration. |
| 4. Less no. of mirrors required to construct spectrophotometer. | 4. More no. of mirrors required to construct spectrophotometer. |
| 5. It can measure single sample at a time. | 5. It can measure multiple sample at same time. |
| 6. A single beam spectrophotometer has only one beam of light. | 6. while a double beam spectrophotometer has two beams of light. |
| 7. As compare to dual beam less accuracy. | 7. High accuracy. |
| 8. In single-beam instruments, because there is only one light path which passes through the sample, it therefore requires manually switching a reference cuvette with the sample cuvette for calibration. | 8. Double beam spectrophotometers operate faster and provide more reproducible results because they perform an automatic correction for the loss of light intensity as the beam passes through the sample and reference solution. |
| 9. Less reproducibility. | 9. Greater reproducibility. |
| 10 Diagram<br>  <br><br>Figure 10.41 Spectrophotometer. | 10 Diagram<br>  <br> |

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| | **(b)** | **What is centrifuge? Describe the working of preparative ultracentrifuge.**<br>**Ans:**<br>**What is centrifuge?**<br>One of the most common equipment used to separate materials into some fractions in a biochemistry lab is the centrifuge. Centrifuge is a device for separating two or more substances from each other by using centrifugal force. A centrifuge is a device that spins liquid sample at high speed & thus creates strong centripetal force causing the denser material to travel towards bottom of the centrifuge tube more rapidly than they would under the force of normal gravity. In other words, centrifuge is a device for separating particles from a solution based on their size, shape, density, viscosity of the medium & rotor speed. | **02** |

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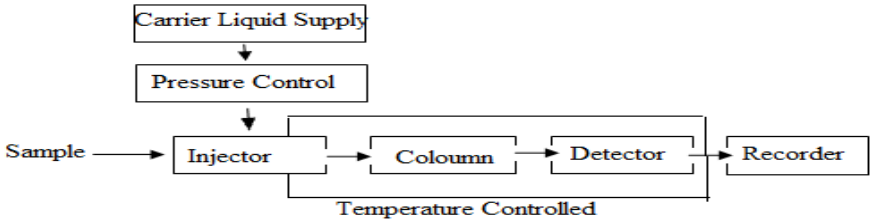
| | | **Working of preparative ultracentrifuge:**<br>The ultracentrifuge is operating at a forces 6 lakh cm/ square and with a temperature control within approximately 0.1 degree Celsius. Mainly it consists of rotor and an optical system for recording the distribution of sample in the ultracentrifuge cell. The rotor is kept in an evacuated on pulled chamber. The tip of the rotor contains a thermistor for measuring the temperature. The thermistor makes electrical contact with the control circuit by means of pull of mercury. The rotor chamber contains an upper condensing lenses and the lower lens allows the passage of the light so that sample is illuminated. The upper lens and camera lens focus the light on the film.<br>Mainly three types of optical system are available for ultra sound<br>1. Ultraviolet light absorption system<br>2. Chill range optical system<br>3. Relay high interference system<br>In ultraviolet system light of suitable wavelength is passed through the moving analytical cell containing the solution under analysis The intensity of transmitted light is recorded on the photographic paper. | **02** |
| | **(c)** | **With neat labelled diagram, explain working of Liquid Chromatography.**<br>**Ans:**<br>  <br>Fig: Liquid Chromatography<br>**Working of Liquid Chromatography:**<br>The basic parts of a liquid chromatograph are shown in figure. It consists of the following parts.<br>1. Carrier liquid supply along with pressure regulator and flow monitor.<br>2. Sample injection system.<br>3. Chromatographic column<br>4. Thermal compartment of thermostat<br>5. The detection system<br>6. The strip chart recorder<br>The carrier gas, normally N2, Ar or He is usually available in a compressed form in a cylinder fitted with a suitable pressure regulator. The gas is conducted from the cylinder through a flow regulator, to a sample injection port maintained at a certain temperature T1, which is such that it ensures rapid vaporization, but not thermal degradation of the solute. Gas and liquid samples are almost always injected by syringe through a self-sealing silicon rubber diaphragm in the injection port. The solute vapor mixes almost instantaneously with the flowing carrier gas and is swept into the chromatographic column, which is the heart of the chromatography. It is there that the different solutes in the vaporized sample are separated from each other, by virtue of their different interaction with the column packing. The column is maintained at another temperature T2. This temperature determines the time for the passage of the solutes and to some extent, the resolution and efficiency obtained with a particular column. At the end of the column the solutes emerging individually enter the detector which produces an electrical signal corresponding to the quantity of solute leaving the column. The detector signal is supplied to a potentiometer recorder and a plot of the time signal amplitude called chromatogram is obtained. | **02**<br>**02** |

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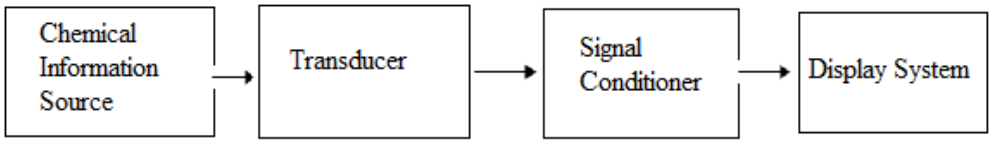
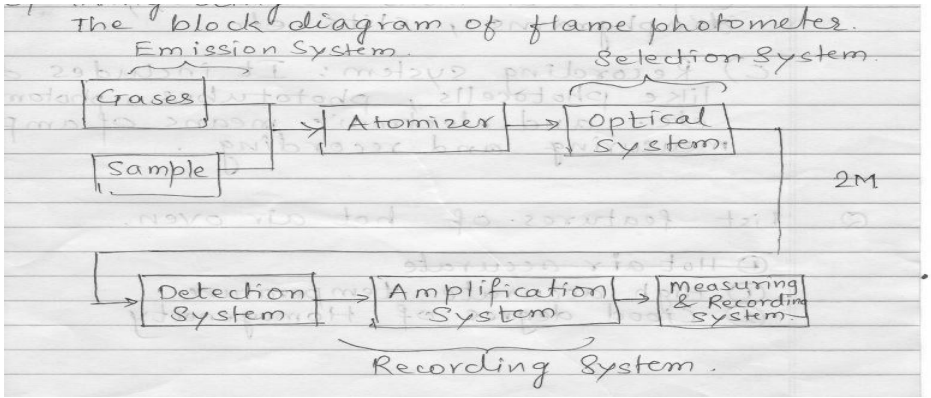
| | **(d)** | **Draw block diagram of analytical instrument. Give function of each block.**<br>**Ans:**<br>  <br>**Fig: Block diagram of analytical instrument**<br>**Function of each block:**<br>1. Chemical information source: It generates a set of signal containing necessary information. It may be the sample itself.<br>2. Transducer: It converts the signal to a one of the different nature. It is generally used to convert nonelectrical phenomenon associated with the analysis of the sample. For e.g. photodiode.<br>3. Signal Conditioner: It converts the o/p of transducer in to an electrical quantity suitable for operation of the display system. It also increases sensitivity of instrument by amplification of original signal.<br>4. Display System: It provides a visible presentation of quantity as a displacement of scale or chart or record. | **02**<br>**02** |
| | **(e)** | **Describe working of flame photometer with neat diagram.**<br>**Ans:**<br>**Working of flame photometer:** The working principle of Emission Flame Photometry is that using compressed air, the diluted sample (often 1:100 or 1:200) is sprayed as fine droplets into a non-luminous gas flame which becomes colored by the characteristic emission of potassium metallic ions in the sample. Using a light filter or prism system, the light of wavelength corresponding to the metal being estimated, is selected. The amount of light emitted depends on the concentration of metallic ions present in the sample.<br>**Basic constituents of a Flame Photometer:**<br>1. Nebulizer<br>2. Mixing chamber with baffles<br>3. Burner<br>4. Photosensitive element<br>5. Wavelength selector<br>  <br>OR | **02**<br>**02** |

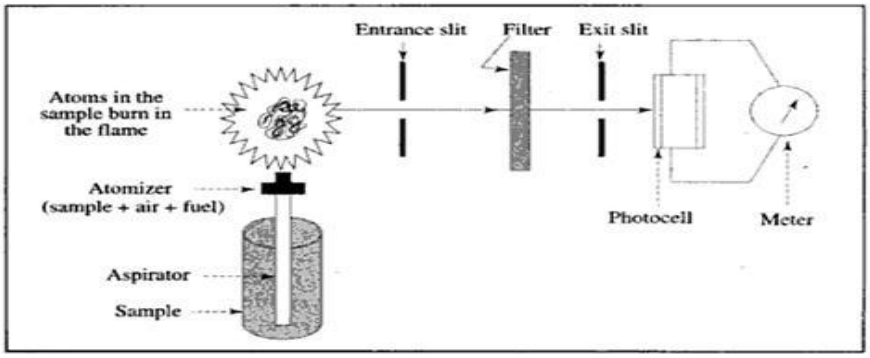



Fig. 7.1 *Working principle of a flame photometer*

**Fig: Flame photometer**